

# EV Grid Integration

## Why It's Important, Methods, Case Studies

### Smart Cities Columbus

Preston Roper  
COO, eMotorWerks

2 November 2016

# The Rise of Electric Cars

By 2022 electric vehicles will cost the same as their internal-combustion counterparts. That's the point of liftoff for sales.



Sources: Data compiled by Bloomberg New Energy Finance, Marklines



# EV Storage - Large, Highly Shift-able Load



**Today!**  
(~200,000 EVs)

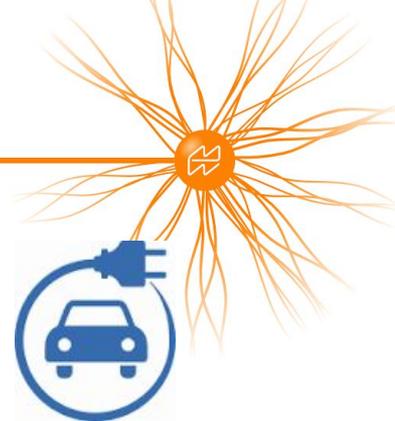
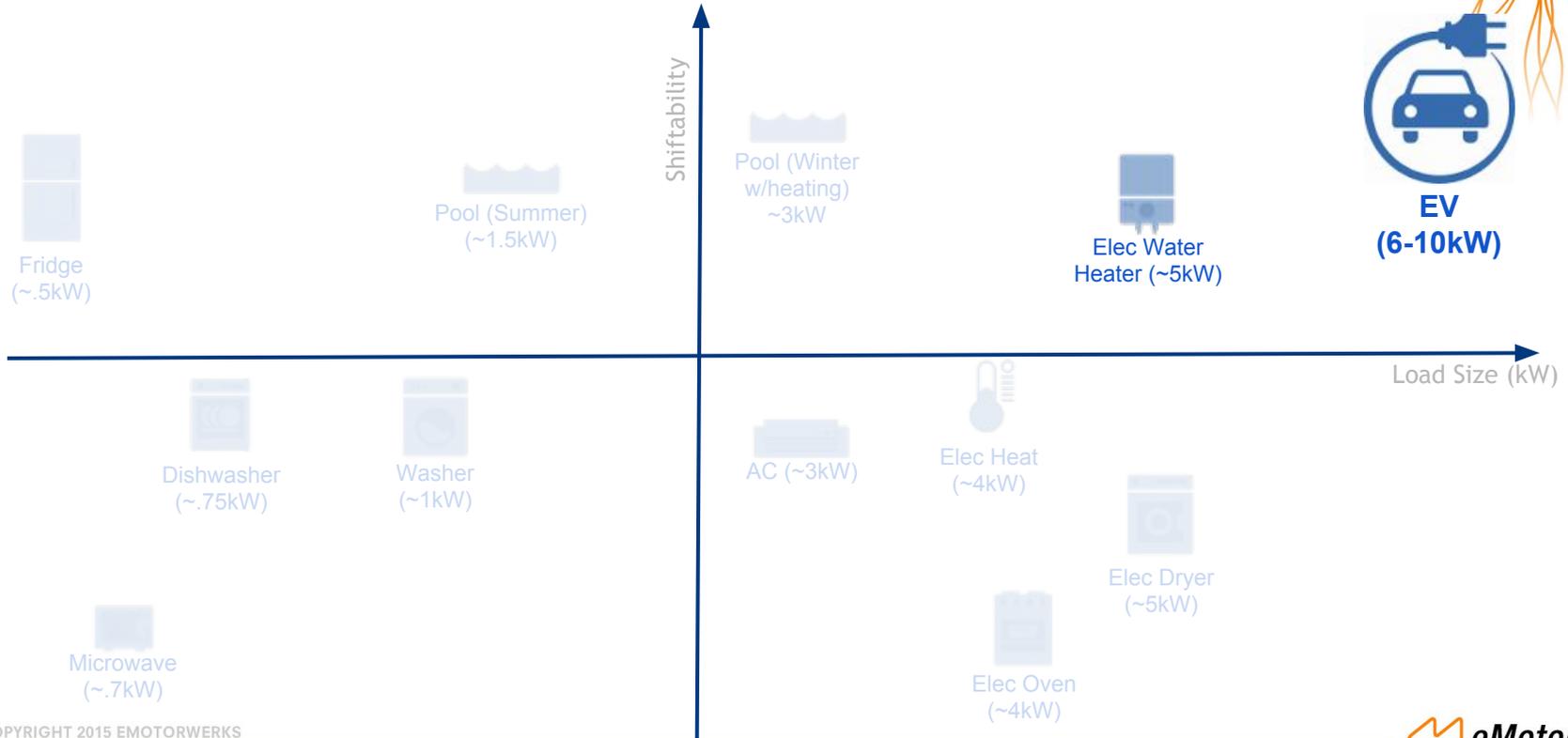


**= 6 GWH  
capacity**

**= 1200 MW**

**= 912 GWH  
energy per  
year**

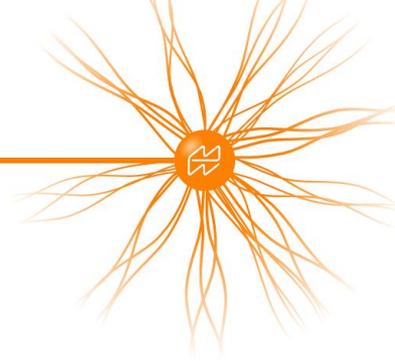
# EV Charging - Largest & Most Flexible Load



**EV**  
**(6-10kW)**

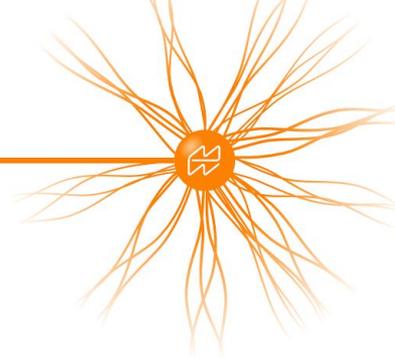
# JuiceNet<sup>®</sup> Energy Services Platform

---



- Modulate large, distributed, shiftable loads such as EVs, water heaters
  - Avoid high-cost peak generation
  - Defer costly grid upgrades
  - Improve grid reliability
  - Integrate more renewables into the grid

# EV Centric “Internet of Load” Platform



- Precise load control
- 3-second control latency
- Instant local grid response
- Remote control API



- Predictive grid model
- Predictive, self-learning driver model
- Cloud-based load management & dispatch
- Cloud-based market engine



*Demand Flexibility:*

Estimated savings of \$9B/year grid investment and \$4B/year in energy and ancillary services costs<sup>1</sup>

# Heterogenous EV Load Access

Better EV Driver Experience & Incentives



## Smart Stations

Amazon best-seller, 12,000+ stations sold, partner to access 50,000+



## JuicePlug™

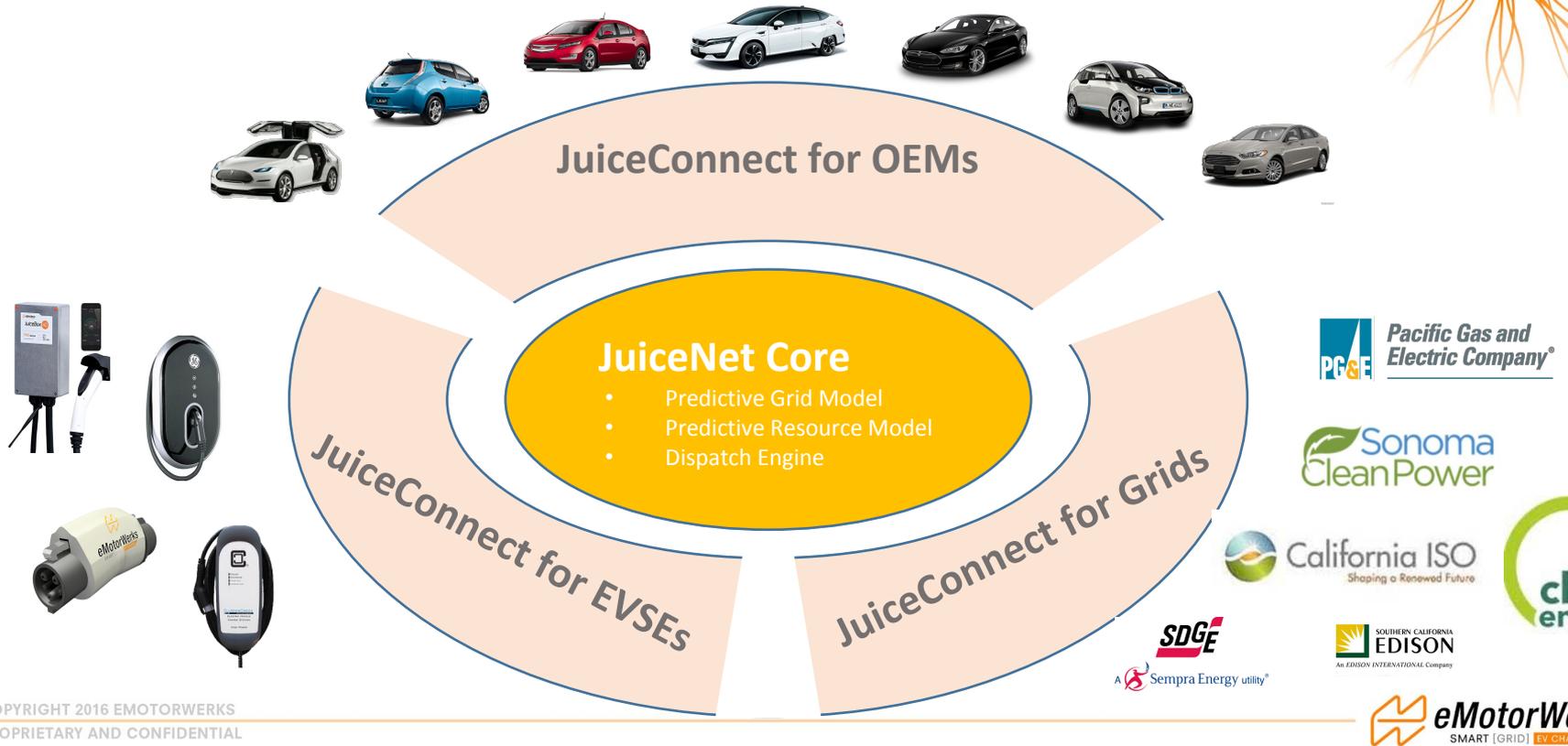
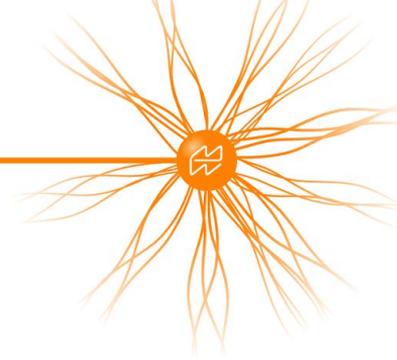
Makes any EV charging smart. Immediate access to the entire EV installed base



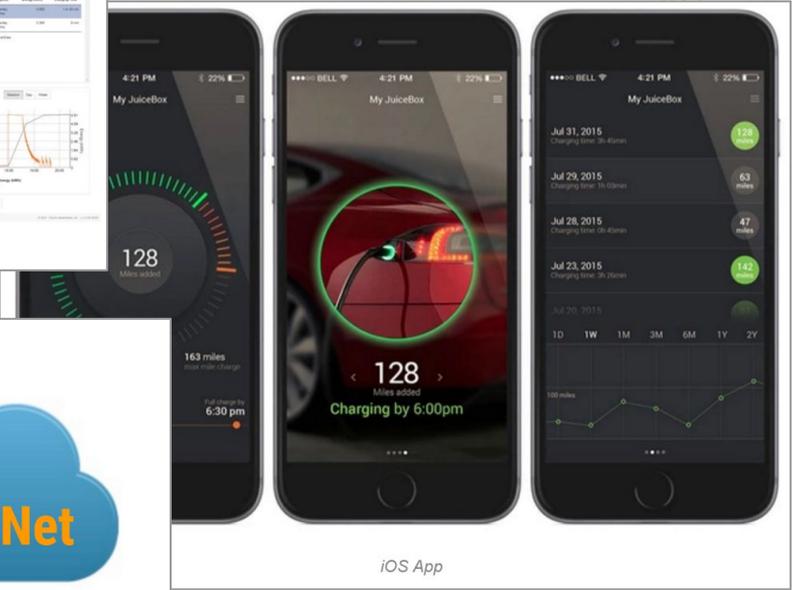
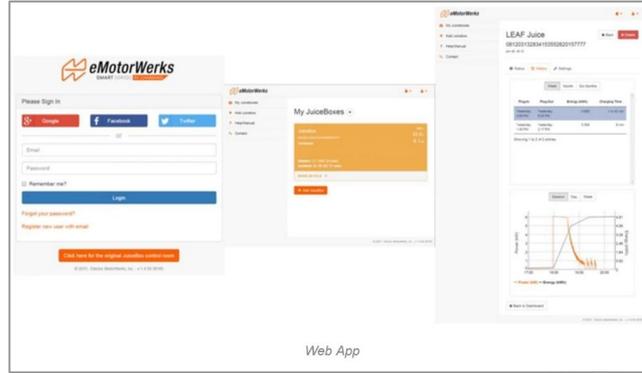
## Direct EV Control

JuiceNet Cloud-to-OEM  
Cloud

# Open Architecture



# Driver Access: App, Portal, Home Automation



# Case Study 1: CPUC Submetering Pilot



- EVSE-as-a-revenue submeter - 12-month review:
  - Deployed across 3 CA IOUs for billing data
  - JuiceBox/JuiceNet: 98% of the pilot EVSEs, 240 stations
  - Saved CPUC between \$2,500 and \$10,000 CAPEX per ratepayer



- Customer Benefits:
  - Lower cost sub-metering alternative
  - Saved \$800-1000 / year in energy costs via EV ToU tariff

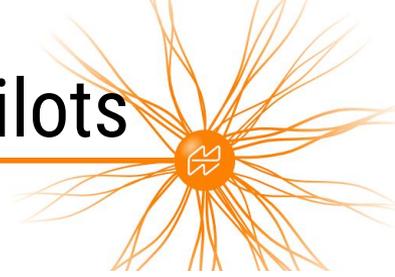


- Phase II plan
  - Commences 1Q17, ~1,000 additional EVs



- Recommendation
  - **Enable broadscale, low-cost revenue submetering via EVSEs**

# Case Study 2: Supply-Side & Excess-Supply Pilots



- Precursor to CA DRAM, sponsored by PG&E
  - CAISO wholesale market participation for PDR resources
  - Bidding and settlement based on market performance
  - Goals: address intermittency, facilitate renewables
- Over 100 eMotorWerks customers currently participating
  - Scalable DERs aggregation
  - Utility and CAISO signal response
- **Recommendation**
  - ***Modernize customer validation & DER enrollment, e.g. secure API-based communications***
  - ***Simplify/eliminate cumbersome end-user agreements***



# Case Study 3: CA DRAM - Key Industry Milestone



- Pay-as-bid auction, with monthly system resource adequacy (RA)
- Sellers can also offer directly into the CAISO day-ahead or real-time energy market
- eMotorWerks: only successful bidder providing resources from EVs → all 3 IOU's
- **Recommendation - setup economically-viable programs early**
  - **Ensure heterogeneous EVSE support**
  - **Target for "critical mass" geographic concentration**
  - **Enable incentives "quiltwork", e.g.**
    - **Broad time of day**
    - **Range of monetizable DER services**
    - **Enable DER aggregation across geographies, e.g. SLAPs (?)**



# Case Study 4 & 5: Muni & CCA Innovation



- Rich incentives to meet customer demand - up to \$1,000
- Multi-vendor EVSE support
- Joint outreach and customer support - “Concierge” charging programs
- DRAM, day-ahead, and real-time market participation, with goal of increasing ROI of local renewable energy projects within resp. service territories
- **Recommendation**  
***Innovate and learn from early deployments***

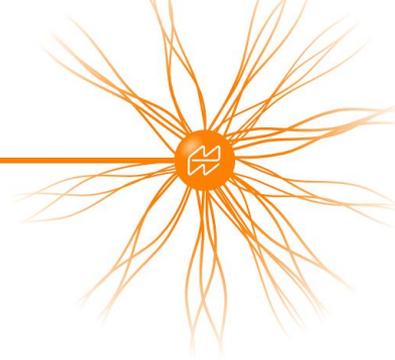


## SmartCharge EV Pilot Program



HOME BUSINESS RESIDENTIAL YOUR OPTIONS





---

# Thank You!

**Preston Roper**  
preston@emotorwerks.com